What Is Claimed Is:

1. A rotor for use in an electrical machine, said rotor having an axis of rotation and comprising:

a first pole piece having a plurality of axially-extending first pole fingers and a first inner rotor portion;

a second pole piece having a plurality of axially-extending second pole fingers and a second inner rotor portion;

a field coil magnetically coupled with said first pole piece and said second pole piece which when energized magnetizes said first pole fingers and said second pole fingers such that said first pole fingers have a north magnetic polarity and said second pole fingers have a south magnetic polarity;

a plurality of permanent magnets having a first set of permanent magnets and a second set of permanent magnets;

one of said first set of permanent magnets disposed between one of said plurality of first pole fingers and one of said plurality of second pole fingers, said one of said first set of permanent magnets having a first radially-inward surface, a first radially-outward surface, a first side surface and a second side surface, wherein said first side surface is adjacent to one of said plurality of first pole fingers and substantially extends the length of one of said plurality of first pole fingers, wherein said second surface is adjacent to one of said plurality of second pole fingers and substantially extends the length of one of said plurality of second pole fingers;

one of said second set of permanent magnets disposed between one of said plurality of first pole fingers and the other of said two adjacent said plurality of second pole fingers and having a second radially-inward surface, a second radially-outward surface, a third side surface and a fourth side surface, wherein said third side surface is adjacent to said first pole finger and substantially extends the length of said first pole finger, wherein said fourth side surface is adjacent to said other of said two adjacent said plurality of second pole fingers and substantially extends the length of said other of said two adjacent said plurality of second pole fingers; and

wherein said first radially-outward surface and said first side surface have a north magnetic polarity and wherein said second radially-outward surface and said fourth side surface have a south magnetic polarity.

2. An electrical machine having a rotor as defined in claim 1.

3. An electrical machine having a rotor according to claim 2, wherein said electrical machine is an alternator.

4. The electrical machine having a rotor as in claim 2, wherein said plurality of permanent magnets produces permanent magnetic flux from one of said first set of permanent magnets to each of said second set of permanent magnets located adjacent to said one of said first set of permanent magnets such that said permanent

magnet flux creates a flux linkage in a stator winding on the electrical machine.

5. The electrical machine of claim 2, wherein said plurality of permanent magnets produces permanent magnetic flux from said one of said first set of permanent magnets to one of said second set of permanent magnets located adjacent to said one of said plurality of permanent magnets such that said magnetic flux acts in opposition to a field current flux in said first pole piece and said second pole piece, whereby said flux linkage is increased in a stator winding of the electrical machine, thereby increasing output power from said stator winding of the electrical machine.

6. The electrical machine of claim 2, wherein said plurality of permanent magnets produces permanent magnetic flux from one of said first set of permanent magnets to one of said second set of permanent magnets located adjacent to said one of said plurality of permanent magnets such that said permanent magnet flux creates a flux linkage in a stator winding on the electrical machine; and wherein said magnetic flux acts in opposition to a field current flux in said first pole piece and said second pole piece, whereby said flux linkage is increased in a stator winding of the electrical machine, thereby increasing output power from said stator winding of the electrical machine.

7. The electrical machine of claim 1, wherein each of said plurality of permanent magnets is affixed to the rotor between one of said plurality of

first pole fingers and one of said plurality of second pole fingers.

8. A rotor for use in an electrical machine, said rotor having an axis of rotation and comprising:

a plurality of axially-extending pole pieces having an inner rotor portion;

a plurality of rotor coils, one of said plurality of rotor coils magnetically coupled with one of said plurality of axially-extending pole pieces which when energized magnetizes said one of said plurality of axially-extending pole pieces such that each adjacent one of said plurality of axially-extending pole piece has an opposite magnetic polarity;

a plurality of permanent magnets having a first set of permanent magnets and a second set of permanent magnets;

one of said first set of permanent magnets disposed between a first adjacent pair of said plurality of axially-extending pole pieces and having a first radially-inward surface, a first radially-outward surface, a first side surface and a second side surface, wherein said first side surface is adjacent to one of said first adjacent pair of pole pieces and extends the length of one of said first adjacent pair of pole pieces, wherein said second surface is adjacent to the other of said first adjacent pair of pole pieces and extends the length of other of said first adjacent pair of pole pieces;

one of said second set of permanent magnets disposed between a second adjacent pair of said plurality of axially-extending pole pieces and having

a second radially-inward surface, a second radially-outward surface, a third side surface and a fourth side surface, wherein said third side surface is adjacent to one of said second adjacent pair of axially-extending pole pieces and extends the length of one of said second adjacent pair of axially-extending pole pieces, wherein said fourth surface is adjacent to the other of said second adjacent pair of axially-extending pole pieces and extends the length of said other of said second adjacent pair of axially-extending pieces;

wherein said other of said first adjacent pair of said plurality of axially-extending pole pieces and said other of said second adjacent pair of said plurality of axially-extending pole pieces have the same magnetic polarity ; and

wherein said first radially-outward surface and said first side surface have a north magnetic polarity and wherein said second radially-outward surface and said fourth side surface have a south magnetic polarity.

9. An electrical machine having a rotor as defined in claim 8.

10. An electrical machine having a rotor according to claim 9, wherein said electrical machine is an alternator.

11. The electrical machine having a rotor as in claim 9, wherein said plurality of permanent magnets produces permanent magnetic flux from said first set of permanent magnets to one of said second set of permanent magnets located adjacent to said one of said

first set of permanent magnets such that said permanent magnet flux creates a flux linkage in a stator winding on the electrical machine.

12. The electrical machine of claim 9, wherein said plurality of permanent magnets produces permanent magnetic flux from one of said first set of permanent magnets to one of said second set of permanent magnets located adjacent to said one of said first set of permanent magnets such that said magnetic flux acts in opposition to a field current flux in said plurality of axially-extending pole pieces, whereby a flux linkage is increased in a stator winding of the electrical machine, thereby increasing output power from said stator winding on the electrical machine.

13. The electrical machine of claim 9, wherein said plurality of permanent magnets produces permanent magnetic flux from one of said first set of permanent magnets to one of said second set of permanent magnets located adjacent to said one of said first set of permanent magnets such that said permanent magnet flux creates a flux linkage in a stator winding on the electrical machine, thereby increasing output power from a stator winding on the electrical machine; and wherein said magnetic flux acts in opposition to a field current flux in said plurality of axially-extending pole pieces, whereby said flux linkage is increased in said stator winding of the electrical machine, thereby increasing output power from said stator winding on the electrical machine.

14. The electrical machine of claim 8, wherein each of said plurality of permanent magnets is affixed to the rotor between an adjacent pair of said axially-extending pole pieces.

15. A method of increasing rotor flux and power output in a hybrid permanent magnet synchronous machine, the method comprising the step of:

generating a permanent magnet flux circulating from one of a first set of permanent magnets through a stator to one of a second set of permanent magnets, said permanent magnet flux continuing from said one of said second set of permanent magnets through one of a first set of poles, an inner rotor portion, and one of a second set of poles, thereby returning to said one of said first set of permanent magnets, wherein said permanent magnet flux in said first set of poles and said second set of poles and said inner rotor portion acts in opposition to a field current magnetic flux generated when a field winding is excited with current.

16. A method according to claim 15, wherein the step of generating a permanent magnet flux comprises the steps of:

disposing a first permanent magnet having a first radially-inward surface, a first radially-outward surface, a first side surface and a second side surface between one of said first set of poles and an adjacent one of said second set of poles, wherein said first radially-outward surface and said first side surface have a first magnetic polarity; and

disposing a second permanent magnet having a second radially-inward surface, a second radially-outward surface, a third side surface and a fourth side surface between said one of said first set of poles and the other adjacent one of said second set of poles, wherein said first side surface substantially extends the length of said one of said first set of poles and is located adjacent to said adjacent one of said first set of poles and wherein said third side surface substantially extends the length of said one of said first poles and is located adjacent to said adjacent one of said first poles, wherein said second radially-outward surface and said fourth side surface have a second magnetic polarity, where said first magnetic polarity and said second magnetic polarity are opposite magnetic polarities.

17. The method according to claim 15, wherein the step of generating a permanent magnet flux comprises the step of generating a permanent magnet flux circulating from one of a first set of permanent magnets through a stator to one of a second set of permanent magnets, said permanent magnet flux continuing from said one of said second set of permanent magnets through one of a first set of poles, an inner rotor portion, and one of a second set of poles, thereby returning to said one of said first set of permanent magnets, wherein said permanent magnet flux said first set of poles and said second set of poles and said inner rotor portion acts in opposition to a field current magnetic flux generated when a field coil is excited with current.

18. The method according to claim 15, wherein the step of generating a permanent magnet flux comprises the step of generating a permanent magnet flux circulating from one of a first set of permanent magnets through a stator to one of a second set of permanent magnets, said permanent magnet flux continuing from said one of said second set of permanent magnets through one of a first set of poles, an inner rotor portion, and one of a second set of poles, thereby returning to said one of said first set of permanent magnets, wherein said permanent magnet flux in said first set of poles and said second set of poles and said inner portion acts in opposition to a field current magnetic flux generated when a rotor coil is excited with current.